

## REVIEW

# Effects of GMO Agricultural Products on Living Things

Ercan Çatak<sup>1\*</sup> Ali Atalay<sup>2</sup>

1. Department of Biology, Faculty of Arts and Sciences, Eskisehir Osmangazi University, Eskisehir, Turkey

2. Department of Statistics, Faculty of Arts and Sciences, Eskisehir Osmangazi University, Eskisehir, Turkey

### ARTICLE INFO

#### Article history

Received: 19 March 2020

Accepted: 3 April 2020

Published Online: 30 April 2020

#### Keywords:

Genetically modified organisms

GMO agricultural products

GMO effects

### ABSTRACT

By obtaining changes on gene sequences of living things with the applied biotechnological methods; The idea of “Genetically Modified Organisms (GMO)”, which aims to bring the living creature in question the original gene combinations with the desired characteristics, came to life in the late twentieth century. Despite the high probability that hunger problems may increase with the increasing world population; It is thought that plant breeding with classical farming methods will be insufficient in solving these problems. With various GMO applications developed all over the world, it aims to produce solutions to these problems. With the presence of GMO, it was possible to increase the shelf life of qualitative and quantitative values of the existing foods. In addition, decreases in agricultural use of pesticides used in agricultural struggle and threatening human health with GMO production are noteworthy. However, some concerns about anomalies that may occur in living things fed GMO products remain on the agenda. Because, in the long term, there is no clear and precise information that GMO will not have negative effects on living things; There are many recorded incidents showing their negative effects.

## 1. Introduction

This review study prepared by evaluating the data obtained as a result of article scans; In addition to the negative effects that can be seen or seen on living things, GMO agricultural products, which are frequently discussed today, are; It is aimed to reveal the existence of positive sides, which may be beneficial and possible for humanity.

The nutritional deficiency problem brought by the increasing world population; it has made scientists obliged to work on the solution of problems by developing new techniques and technologies in this field. Because it is estimated that trying to solve the problem by increasing the

areas where agriculture can be done will not be sufficient due to population growth. Biotechnological methods, developed to prevent the ever-increasing hunger problem and to meet the standard nutritional needs, have had wide repercussions and found serious support all over the world. According to Tecer, it seems inevitable to use new technologies in plant breeding studies, considering that it has come to the limits of using classical plant breeding methods for increasing yield in nutrients<sup>[1]</sup>. The ideas that were introduced towards the end of the twentieth century, by interfering with the genetic structures of foods, that qualitative and quantitative increases in food production could be made caused the birth of the “Genetically Modified Organisms (GMO)” technology. This important

\*Corresponding Author:

Ercan Çatak,

Department of Biology, Faculty of Arts and Sciences, Eskisehir Osmangazi University, Eskisehir, Turkey;

Email: [ecatak@ogu.edu.tr](mailto:ecatak@ogu.edu.tr)

discovery that excites the world of science; The public was found to be equivalent to the invention of the printing press, the discovery of fire, and the disintegration of the atom [2]. Organisms obtained by changing the gene sequences of living creatures by using biotechnological methods, changing their properties or gaining new properties to them are called “GMOs” [3,4].

In GMO technology, it is aimed to increase the resistance of plants against all pests in addition to increasing the yield in the production of plants. In addition, agricultural products have extra features that will increase their shelf life in the market with GMO technique. As stated by Çetiner regarding this; The most common trait transferred to plants is herbicide resistance genes, which significantly reduces the production costs of farmers. BT, which is the *Bacillus thuringiensis* endotoxin gene that provides resistance to lipidoters, is also effective against caterpillars that are harmful for corn and cotton. In this way, drug consumption decreases in the agricultural struggle and both the cost decreases and the negative effects that may occur for the environment and human health are reduced [5].

In addition to numerous scientific studies showing the benefits of GMO agricultural products to the creatures fed with them; The number of studies showing that it threatens health is also at a considerable level. In this review study, the results of the literature review were made; The positive and harmful effects of transgenic plants on living things have been studied.

## 2. GMOs in Agricultural Field

Like the production of vaccines and antibiotics that are considered as milestones in human history, GMO production is also considered a major revolution. This biotechnological invention, discovered towards the end of the twentieth century, has entered our lives at a very high level today. So much so that agricultural products such as potatoes, corn, soy, tomatoes, which are frequently consumed today, appear as GMO products. These biotechnological interventions to increase efficiency and quality in such food products; The fact that the properties that are basically not in the plant are taken from another creature and transferred to the plants brought along some question marks and concerns. For example, when you isolate the cold resistance gene that we want to see in tomato by transferring it from tomato to tomato, you can make the tomato resistant to cold. However, not being able to predict what kind of abnormal reactions this new genetic code, which is not found in the gene pool of tomato, can cause in living things that consume that tomato, causes concern. Moreover, there is no clear information about the effects that GMO products may cause in the long term.

Some authorities have expressed concerns about the potential hazards that may arise due to the out-of-control spread of genes, which are created during the transfer of genes. As a result of this situation, it is concluded that the natural fauna and flora, where new wild species may emerge in nature, may be negatively affected and the balance between the species may be disturbed [6].

Transgenic plants, which were first commercially produced in 1996, continue to be cultivated in more varieties and areas today. GD plant planting area, which started in 1996 in an area of approximately 2 million hectares in the world, has exceeded 185 million hectares according to 2016 data (Table 1). In addition to the increasing world population, the gradually decreasing areas to be used for agriculture encourages GMO production.

**Table 1.** GM plant cultivated area amounts in the world, 1996 - 2016 [7,8]

Years	Cultivated Area (Million Hectares)	Index(1996=100)
1996	1,7	100
1997	11	647
1998	27,8	1.635
1999	39,9	2.347
2000	44,2	2.600
2001	52,6	3.094
2002	58,7	3.452
2003	67,7	3.982
2004	81	4.764
2005	90	5.294
2006	102	6.000
2007	114,3	6.723
2008	125	7.352
2009	134	7.882
2010	148	8.705
2011	160	9.411
2012	170,3	10.017
2013	175,2	10.305
2014	181,5	10.676
2015	179,7	10.570
2016	185,1	10.888
Toplam	2.149,7	-

## 3. Positive and Negative Effects of Agricultural Sourced GMOs

### 3.1 Benefits of GMOs

Special industry members, scientists, food technology and food experts, food processors, distributors, retailers,

American farmers, regulatory agencies, advocates of poor and hungry people and supporters of green revolution in the world; With the facilitated genetic engineering, they think that the food and medicine required due to the increasing world population can be produced in large quantities <sup>[2]</sup>.

Russett Burbank potatoes, whose starch content was developed more than usual by Monsanto Company, produced potatoes that reduced less cooking time, reduced cooking time and cost during the frying process <sup>[9]</sup>.

To increase the carbohydrate content of GMOs, tomatoes can be used in products such as ketchup and tomato sauce to be more intense <sup>[2]</sup>.

Fats that are responsible for the production of cholesterol in the body are high in saturated fat. Fats that are low in saturated fat and high in unsaturated fat, which are important for our health; It is used in frying and other processes and is resistant to high temperatures. The genetics of these plants can be changed to further increase the level of unsaturated fatty acids in existing oils of plants such as canola, soy, sunflower and peanut, which are frequently used to obtain oil <sup>[2]</sup>.

In addition to improving the nutritional quality of food products, GMO products are produced to increase their contribution to health. With GMO technology, the levels of anti-oxidant vitamins (vitamins A, C and E), carotenoids, flavonoids and minerals, which increase the heart disease, some cancers and some natural compounds that cause blindness and slow down or prevent biological oxidation, is also increased <sup>[2]</sup>.

When the allergen proteins in foods such as hazelnuts, peanuts and wheat, which can cause allergic reactions in humans, are extracted with GMO technology, it is possible to completely or partially get rid of the possible allergen reactions.

### 3.2 Losses of GMO

The expression and genetic function of the transgene introduced into genetically modified organisms can lead to unpredictable changes in living things. Thus, the protein product of the transgene can cause unpredictable reactions and the emergence of potential toxins <sup>[10]</sup>.

The results of the study on mice fed transgenic potato against genetically modified production pests showed that; cancer cells develop in rats; brain, liver, and testicle development are prevented; Some of the liver is blunted and histological differences appear in the pancreas and intestines <sup>[6]</sup>.

## 4. Results and Discussion

As it turns out, reactions about the health-threatening

effects of GMO products in the short and long term will continue to keep the world agenda busy and react.

The lack of complete and clear information on the long-term effects of GMO products on health suggests that labeling transgenic products should inform consumers and ensure their right to choose <sup>[11]</sup>. Research results in five states in the US have shown that consumers feel that GMOs do not have adequate protection against “unknown” and “unpredictable” health risks <sup>[12]</sup>.

If GMO products threaten genetic diversity, an irreversible process will also be entered. For this reason, such products should be offered for consumption after sufficient scientific researches and their use should be constantly checked within the legal framework <sup>[13]</sup>. International conventions on this should also be implemented meticulously.

In order for the Biosafety Law in force to serve the effective and safe use of GMOs, the public should be made conscious of scientific resources <sup>[14]</sup>.

GMO agricultural products are like double-edged knives; In addition to the benefits it provides, it is necessary to take measures by knowing the existence of possible harm to living things. Scientific studies to increase the nutritional quality and quantity in agricultural products should also be supported in a controlled manner.

## References

- [1] Atsan, T., Kaya, T. E., Genetiği Değiştirilmiş Organizmaların (GDO) Effects on Agriculture and Human Health, *Journal of Faculty of Agriculture*, 2008, 22(2): 1-6. (In Turkish)
- [2] Uzogara, S. G., The Impact of Genetic Modification of human Foods in The 21st Century, *Biotechnology Advances*, 2000, 18: 179-206. (In Turkish)
- [3] Kulaç, İ., Ağirdil, Y., Yakın, M., Sweet Trouble in Our Table, *Genetically Modified Organisms and Their Effects on Public Health*, *Turkish Journal of Biochemistry*, 2006, 31(3): 151-5. (In Turkish)
- [4] Beyatlı, y., *Biotechnology Lecture Notes*, Gazi University, Faculty of Arts and Sciences, Department of Biology, Ankara, 2000, 146. (In Turkish)
- [5] Çetiner, S., *Turkey and the World Agricultural Biotechnology and Food Security: Issues and Recommendations*, food Cooperation Platform, 2008. (In Turkish)  
[http://students.sabanciuniv.edu/~sedakaya/index.php?option=com\\_content&task=view&id=61&Itemid=76](http://students.sabanciuniv.edu/~sedakaya/index.php?option=com_content&task=view&id=61&Itemid=76)
- [6] Cebirbay, M. A., Aktaş, N., *Genetiği Değiştirilmiş Organizmalar (GDO) and Its Effects*, Billur Publishing, 2018, 309-325. (In Turkish)

- [7] Hall C, Knight B, Ringrose S, Knox OGG. What have been The Farm-level Economic Impacts of the Global Cultivation of GM Crops?. *Collaboration for Environmental Evidence*, 2013, 11: 1-45.
- [8] ISAAA. Global Status of Commercialized Biotech/ GM Crops: 2016, Brief 52.  
<http://www.isaaa.org/resources/publications/briefs/52/download/isaaa-brief-52-2016.pdf>.
- [9] Whitney, S.L., et al. This Food May Contain. What Nurses Should Know About Genetically Engineered Foods, *Nursing Outlook*, 2004, 52(5): 262-266.
- [10] Fagan, J.B.. Genetically Engineered Food-A Serious Health Risk, 2005.  
<http://www.netlink.de/gen/fagan.html>
- [11] Topal, Ş.. Genetic Modification Procedures and Biosafety, *Wheat*, 2004, 26. (In Turkish)  
<http://www.bugday.org>.
- [12] Zimmerman, L., Kendall, P., Stone, M., Hoban, T.. Consumer Knowledge and Concern About Biotechnology and Food Safety, *Food Technology*, 1994, 73-77.
- [13] Çelik, V., Turgut-Balık, D.. Genetiği Değiştirilmiş Organizmalar (GDO), Erciyes University, *Journal of the Institute of Science*, 23(1-2): 13-23. (In Turkish)
- [14] Özdemir, O., Duran M.. Biotechnological Applications and Genetiği Değiştirilmiş Organizmalara (GDO) Related Consumer Behavior, *Akademik Gıda*, 2010, 8(5): 20-28. (In Turkish)